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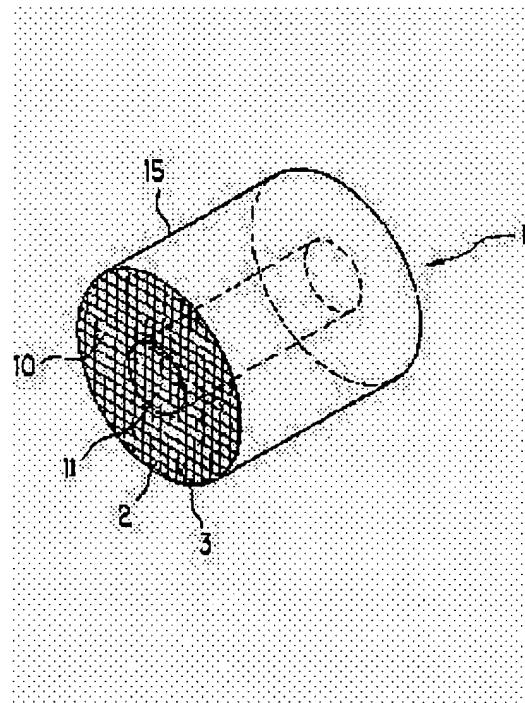
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(54) HONEYCOMB STRUCTURE AND METHOD FOR MANUFACTURING THE HONEYCOMB STRUCTURE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a honeycomb structure with such advantages that a differing high performance complying with requirements per each honeycomb part can be exhibited and each honeycomb part is free from a shape non- matching or the local concentration of stress due to the presence of a joint material and further, the reliability is high during use.

SOLUTION: This honeycomb structure 1 has a plurality of through holes 3 formed in the axial direction by a plurality of partition walls 2. In addition, the honeycomb structure 1 is constituted of a plurality of the honeycomb parts 10 and 11 formed of materials of different properties, the honeycomb parts 10 and 11 being directly joined together in one piece.



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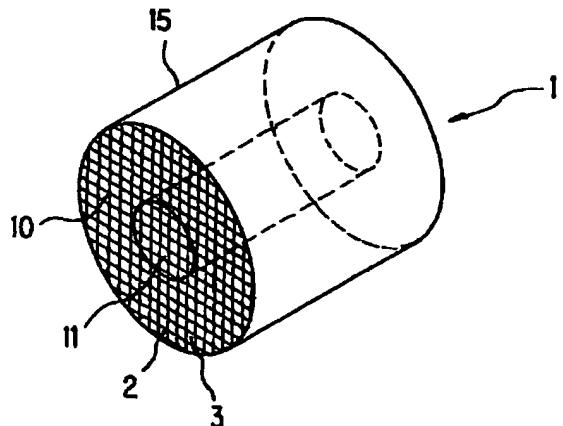
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(54)【発明の名称】 ハニカム構造体、及びその製造方法

(57)【要約】

【課題】 各ハニカム部毎に要求に応じた異なる高い性能を発揮することができ、しかも、各ハニカム部の形状不整合や接合材の存在による局所的な応力の集中がなく、使用時等の際に信頼性の高いハニカム構造体を提供する。

【解決手段】 複数の隔壁2により、軸方向に、複数の貫通孔3が形成されているハニカム構造体1である。ハニカム構造体1を、異なる特性の材料からなる複数のハニカム部10、11により構成し、かつこの複数のハニカム部10、11を、それぞれ直接接合して一体化する。



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【特許請求の範囲】

【請求項1】 複数の隔壁により、軸方向に、複数の貫通孔が形成されているハニカム構造体であって、該ハニカム構造体が、異なる特性の材料からなる複数のハニカム部により構成され、かつ該複数のハニカム部が、それぞれ直接接合して一体化されていることを特徴とするハニカム構造体。

【請求項2】 該異なる特性の材料からなる複数のハニカム部が、ハニカム構造体の中心軸を含む中央領域に設けられる、異なる特性の一の材料からなる第一のハニカム部と、中央領域を包囲して隣接する外周領域に設けられる、異なる特性の他の材料からなる第二のハニカム部とにより構成されている請求項1に記載のハニカム構造体。

【請求項3】 該複数のハニカム部を構成する材料が、気孔率、平均細孔径、又は吸水率の少なくとも1種の特性で相違する請求項1又は2に記載のハニカム構造体。

【請求項4】 該複数のハニカム部を構成する材料が、気孔率5~80%である請求項1~3のいずれか一項に記載のハニカム構造体。

【請求項5】 該複数のハニカム部を構成する材料が、平均細孔径0.5~100μmである請求項1~4のいずれか一項に記載のハニカム構造体。

【請求項6】 該複数のハニカム部を構成する材料が、吸水率1~95%である請求項1~5のいずれか一項に記載のハニカム構造体。

【請求項7】 該ハニカム構造体が、そのセル構造のうち、セル密度、隔壁厚さ、又は該貫通孔における径方向の断面形状の少なくとも1種で異なる複数のハニカム部により構成されている請求項1~6のいずれか一項に記載のハニカム構造体。

【請求項8】 該異なるセル構造の複数のハニカム部が、該異なる特性の材料からなる複数のハニカム部に、実質的に対応して設けられている請求項1~7のいずれか一項に記載のハニカム構造体。

【請求項9】 該複数のハニカム部が、0.155~3.101セル/mm²(100~2000セル/平方インチ)のセル密度を有する請求項7又は8に記載のハニカム構造体。

【請求項10】 該複数のハニカム部の隔壁が、25~500μmの厚さを有する請求項7~9のいずれか一項に記載のハニカム構造体。

【請求項11】 該複数のハニカム部を構成する材料が、コーディエライト、炭化珪素、窒化珪素、アルミニナ、ムライト、リチウムアルミニウムシリケート、アルミニウムチタネット、及びジルコニアからなる群より選ばれた少なくとも1種である請求項1~10のいずれか一項に記載のハニカム構造体。

【請求項12】 該複数のハニカム部の一部が、該隔壁に触媒能を有する金属を担持してなる請求項1~11の

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いずれか一項に記載のハニカム構造体。

【請求項13】 該複数のハニカム部の一部が、該隔壁に炭化水素を吸着する吸着層を有する請求項1~12のいずれか一項に記載のハニカム構造体。

【請求項14】 該複数のハニカム部の一部が、汎過能を有する隔壁により構成され、該汎過能を有する隔壁により形成される貫通孔を、該貫通孔が貫通する両端面で、所定の貫通孔については一方の端部を封じ、残余の貫通孔については他方の端部を封じて目封じしてなる請求項1~13のいずれか一項に記載のハニカム構造体。

【請求項15】 含塵流体中に含まれる粒子状物質を捕集・除去するフィルターとして用いられる請求項14に記載のハニカム構造体。

【請求項16】 セラミックス材料を主成分とする原料と媒質とを混練して坯土を得、該坯土を押出し成形するハニカム構造体の製造方法であって、該セラミックス材料を主成分とする原料として、焼成後の特性が異なる複数の原料を用い、

該複数の原料を、それぞれ異なる混練機構で該媒質と混練して、焼成後の特性が異なる複数の坯土を得、該複数の坯土を、それぞれ口金の異なる位置に導入した後、該複数の坯土を同時に押出しすることを特徴とするハニカム構造体の製造方法。

【請求項17】 該複数の坯土を一体化した複合坯土を該口金に導入して、該複数の坯土を同時に押出しする請求項16に記載のハニカム構造体の製造方法。

【請求項18】 該複合坯土が、一の材料からなる一の坯土の周間に、該一の坯土とは焼成後の特性が異なる少なくとも1以上の他の坯土を配設してなるものである請求項17に記載のハニカム構造体の製造方法。

【請求項19】 該複数の坯土を、それぞれ異なる押出し機構により、口金の異なる位置に導入して、同時に押出しする請求項18に記載のハニカム構造体の製造方法。

【請求項20】 該押出し機構が、該セラミックス材料を主成分とする原料と該媒質との混練、及び該混練により得られる坯土の押出しを、一連の工程により連續的に行うスクリュー式の押出し機構である請求項19に記載のハニカム構造体の製造方法。

【請求項21】 該複数の原料が、その焼成後の特性のうち、気孔率、平均細孔径、又は吸水率の少なくとも1種で異なる請求項16~20のいずれか一項に記載のハニカム構造体の製造方法。

【請求項22】 該口金の、セルブロックピッチ、スリット幅、又はセルブロックの押出し方向に対する垂直方向の断面形状の少なくとも1種が、該焼成後の特性が異なる各坯土が導入される部位毎に、実質的に相違する請求項16~21のいずれか一項に記載のハニカム構造体の製造方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、ハニカム構造体に関する。より詳しくは、異なる特性の複数の材料からなり、特定部位毎に異なる複数の機能を兼備するハニカム構造体であり、特に、排ガス浄化システム、熱交換器、固体電解質電池、音響波動冷却装置等の熱音響機関等に好適なハニカム構造体に関するものである。

【0002】

【従来の技術】 従来、排ガス浄化手段については、①ハニカム構造体の隔壁に触媒機能を有する金属を担持した触媒体を用いて、排ガス中の炭化水素、一酸化炭素、又は窒素酸化物等の成分を酸化還元反応により分解する排ガス浄化手段、

②ハニカム構造体の隔壁を多孔質材料により構成させ、隔壁により形成される貫通孔を、貫通する両端面で、所定の貫通孔については一方の端面で目封じし、残余の貫通孔については他方の端面で目封じした構造とすることにより、排ガス中の粒子状物質を、隔壁により捕集・除去する排ガス浄化手段、

③ハニカム構造体の隔壁にゼオライト、活性炭等からなる吸着層を設けて、排ガス中の炭化水素成分等を吸着・除去する排ガス浄化手段等、種々の試みがなされている。

【0003】 また、近年、排ガス規制強化等に伴い、より高い浄化性能が求められており、その要請に応じる試みの1つとして、上述した異なる排ガス浄化手段を組合せた排ガス浄化システムが開発されている。

【0004】 例えば、特開平7-232084号公報には、異なる隔壁厚さ、及びセル密度の円柱状のハニカム構造体と、中空円筒状のハニカム構造体とを、セラミックス接合材で接合したハニカム構造体が開示されている。

【0005】 しかしながら、このハニカム構造体では、各ハニカム構造体を別々に、しかも両者の形状を精密に合致させて製造する必要があった。このため、製造工程が複雑になり、製造コストが高くなるとともに、両者の形状の不整合に起因する接合部の緩み、はずれ等を生じ易かった。

【0006】 また、このハニカム構造体では、接合部に应力が集中し易く、工程間の輸送、触媒や吸着材の付与、キャニング又は実使用等の際における機械的衝撃及び熱的衝撃等により、接合部の緩み、はずれ等を生じ易いという問題があった。

【0007】 一方、WO01/04466公報には、触媒体とフィルターが直接一体化されているハニカム構造体が開示されている。

【0008】 しかしながら、このハニカム構造体では、従来、セラミックス質のハニカム構造体について、異なる特性の材料からなるものを同時に一体的に製造する技術が開発されていなかったこともあり、触媒体とフ

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ィルターとで、求められる性能が大きく異なるにも拘らず、ハニカム構造体全体で、同一の特性を有する材料により構成されていたのが現状であった。

【0009】 即ち、このハニカム構造体では、触媒体及びフィルターとして求められる性能に応じて、最適な材料により構成するといった点は何ら考慮されておらず、触媒体とフィルターとしての機能を兼備させたにも拘わらず、触媒体、及びフィルターとして求められる本来の性能を充分に發揮できるものではなかった。

【0010】

【発明が解決しようとする課題】 本発明は、上述の課題に鑑みてなされたものであり、各ハニカム部毎に要求に応じた異なる高い性能を発揮することができ、しかも、各ハニカム部の形状不整合や接合材の存在による局所的な応力の集中がなく、使用時等の際に信頼性の高いハニカム構造体を提供することを目的とする。また、本発明は、このような優れた特性を有するハニカム構造体を、簡易且つ確実な行程により低成本で製造することができる製造方法を提供することを目的とする。

【0011】

【課題を解決するための手段】 本発明の発明者は、上述の目的を達成すべく銳意検討したところ、異なる機能を有する各ハニカム部毎に、求められる性能に応じて異なる特性の材料により構成するとともに、各ハニカム部を接合材を介さずに直接接合することにより、上述した問題を解決できることを見出し、本発明のハニカム構造体を完成した。また、本発明の発明者は、焼成後の特性が異なる材料からなる複数の抔土を、同時に押出し成形することにより、このようなハニカム構造体を簡易且つ確実に製造できることを見出し、本発明の製造方法を完成した。

【0012】 即ち、本発明によれば、複数の隔壁により、軸方向に、複数の貫通孔が形成されているハニカム構造体であって、ハニカム構造体が、異なる特性の材料からなる複数のハニカム部により構成され、かつ該複数のハニカム部が、それぞれ直接接合して一体化されていることを特徴とするハニカム構造体が提供される。

【0013】 本発明においては、異なる特性の材料からなる複数のハニカム部が、ハニカム構造体の中心軸を含む中央領域に設けられる、異なる特性の一の材料からなる第一のハニカム部と、中央領域を包囲して隣接する外周領域に設けられる、異なる特性の他の材料からなる第二のハニカム部とにより構成されていることが好ましい。

【0014】 また、本発明においては、複数のハニカム部を構成する材料が、気孔率、平均細孔径、又は吸水率の少なくとも1種の特性で相違することが好ましい。この際、複数のハニカム部を構成する材料は、気孔率が5~80%であることが好ましく、平均細孔径が0.5~100μmであることが好ましく、吸水率が1~95

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%であることが好ましい。

【0015】 また、本発明においては、更に、ハニカム構造体を、そのセル構造のうち、セル密度、隔壁厚さ、又は貫通孔における径方向の断面形状の少なくとも1種において異なる複数のハニカム部により構成することも好ましく、この際には、セル構造が相違する複数のハニカム部が、異なる特性の材料からなる複数のハニカム部に、実質的に対応して設けられていることが好ましい。

【0016】 本発明においては、セル構造が相違する複数のハニカム部は、0.155～3.101セル/m² (100～2000セル/平方インチ) のセル密度を有することが好ましく、25～500μmの隔壁厚さを有することが好ましい。

【0017】 なお、本発明においては、複数のハニカム部を構成する材料として、コーディエライト、炭化珪素、窒化珪素、アルミナ、ムライト、リチウムアルミニウムシリケート、アルミニウムチタネート、及びジルコニアからなる群より選ばれた少なくとも1種を用いることができる。

【0018】 また、本発明においては、触媒体としての性能を付与するのであれば、少なくとも一部のハニカム部の隔壁に、触媒能を有する金属を担持すればよく、吸着体としての性能を付与するのであれば、少なくとも一部のハニカム部の隔壁に、炭化水素吸着能を有する吸着層を設ければよく、含塵流体中に含まれる粒子状物質を捕集・除去するフィルターとしての性能を付与するのであれば、少なくとも一部のハニカム部を、渦過能を有する隔壁により構成させ、この渦過能を有する隔壁により形成される貫通孔を、貫通孔が貫通する両端面で所定の貫通孔については一方の端部を封じ、残余の貫通孔については他方の端部を封じて目封じすればよい。

【0019】 他方、本発明によれば、セラミックス材料を主成分とする原料と、媒質とを混練して坯土を得、この坯土を押出し成形するハニカム構造体の製造方法であって、セラミックス材料を主成分とする原料として、焼成後の特性が異なる複数の原料を用い、この複数の原料を、それぞれ異なる混練機構で媒質と混練して、焼成後の特性が異なる複数の坯土を得、この複数の坯土を、それぞれ口金の異なる位置に導入した後、同時に押出しすることを特徴とするハニカム構造体の製造方法が提供される。

【0020】 本発明の製造方法において、複数の坯土を、それぞれ口金の異なる位置に導入した後、同時に押出しする手段としては、複数の坯土を一体とした複合坯土を口金に導入して、複数の坯土を同時に押出しする方法が好ましい。

【0021】 この際、複合坯土は、一の材料からなる一の坯土の周囲に、一の坯土とは焼成後の特性が異なる少なくとも1以上の他の坯土を配設してなるものが好ま

しい。

【0022】 また、本発明の製造方法において、複数の坯土を、それぞれ口金の異なる位置に導入した後、同時に押出しする他の手段としては、複数の坯土を、それぞれ異なる押出し機構により、口金の異なる位置に導入した後、同時に押出し成形する方法も好ましい。

【0023】 この際、押出し機構としてシリンジ式の押出し機構を用いてもよいが、スクリュー式の押出し機構とすることにより、セラミックス材料を主成分とする10 原料と媒質との混練、及び混練により得られる坯土の押出しを、一連の工程により連続的に行なうことが好ましい。

【0024】 また、本発明の製造方法においては、セラミックス材料を主成分とする原料が、気孔率、平均細孔径、又は吸水率の少なくとも1種から選ばれる焼成後の特性で相違することが好ましい。

【0025】 また、口金として、セルブロックピッチ、スリット幅、又はセルブロックの押出し方向に対する垂直方向の断面形状の少なくとも1種が、異なる特性20 の坯土が導入される部位毎に、実質的に相違するものを用いることも好ましい。

【0026】

【発明の実施の形態】 以下、本発明の実施の形態を、図面を参照しつつ具体的に説明する。

【0027】 図1に示すように、本発明のハニカム構造体1は、複数の隔壁2により、軸方向に、複数の貫通孔3が形成されているものであり、ハニカム構造体1が、異なる特性の材料からなる複数のハニカム部10、11により構成され、かつこの複数のハニカム部10、11が、それぞれ直接接合して一体化されているものである。

【0028】 これにより、各ハニカム部10、11が、求められる性能に応じて、異なる高い性能を發揮することができ、しかも、各ハニカム部10、11の形状不整合や接合材の存在による局所的な応力集中がなく、使用時等における信頼性を向上させることができる。以下、具体的に説明する。

【0029】 本発明においては、複数のハニカム部10、11を構成する材料として、例えば、コーディエライト、金属シリコン、炭化珪素、窒化珪素、アルミナ、ムライト、リチウムアルミニウムシリケート、アルミニウムチタネート、及びジルコニアからなる群より選ばれた少なくとも1種を挙げることができる。

【0030】 また、ハニカム部10、11を構成する材料の特性としては、例えば、気孔率、平均細孔径、吸水率、又は比熱等を挙げることができ、本発明においては、これらの特性の少なくとも1種を、各ハニカム部10、11で求められる性能に応じて、異なるものとすることが好ましい。

【0031】 例えば、触媒体又は吸着体として用いら

れるハニカム部10では、気孔率を20~40%、平均細孔径を1~80μm、吸水率を1~40%とすることが好ましく、気孔率を25~35%、平均細孔径を1~60μm、吸水率を4~35%とすることがより好ましい。

【0032】また、例えば、フィルターとして用いられるハニカム部11では、気孔率を40~80%、平均細孔径を5~45μmとすることが好ましく、気孔率を40~70%、平均細孔径を10~40μmとすることがより好ましい。

【0033】また、如何なる性能を付与するハニカム部10、11であっても、ハニカム構造体1の軽量化、及び強度を考慮すると、それぞれ、気孔率を5~80%、平均細孔径を0.5~100μm、吸水率を1~95%とすることが好ましく、それぞれ、気孔率を25~70%、平均細孔径を1~60μm、吸水率を4~92%とすることがより好ましい。

【0034】本発明においては、各ハニカム部10、11毎に異なる材料により構成させることにより、各ハニカム部10、11の材料特性を異ならしめたものでもよく、同一の材料により各ハニカム部10、11を構成させながらも、材料特性を異ならしめたものでもよい。後者の場合としては、例えば、同一種類の材料で構成させながら、気孔率、細孔径等を異ならしめたものを挙げることができ、例えば、原料中に結晶成長助剤、造孔材等を添加することにより、このようなハニカム構造体とすることができる。

【0035】図2、図3に示すように、本発明のハニカム構造体1においては、更に、求められる各ハニカム部12、13の性能に応じて、そのセル構造のうち、セル密度、隔壁厚さ、又は貫通孔における径方向の断面形状等の少なくとも1種が異なる複数のハニカム部12、13により構成させることもできる。

【0036】例えば、触媒体又は吸着体として用いられるハニカム部では、それぞれ、セル密度を0.465~3.101セル/mm²(300~2000セル/平方インチ)、隔壁厚さを25~300μm、貫通孔における径方向の断面形状を三角形、四角形、六角形、又は円形とすることが好ましく、それぞれセル密度を0.930~3.101セル/mm²(600~2000セル/平方インチ)、隔壁厚さを25~100μmとすることがより好ましい。

【0037】また、例えば、フィルターとして用いられるハニカム部では、それぞれ、セル密度を0.155~0.620セル/mm²(100~400セル/平方インチ)、隔壁厚さを100~500μm、貫通孔における径方向の断面形状を三角形、四角形、又は六角形とすることが好ましく、それぞれ、セル密度を0.236~0.465セル/mm²(150~300セル/平方インチ)、隔壁厚さを200~300μm、貫通孔にお

ける径方向の断面形状を四角形とすることがより好ましい。

【0038】また、如何なる性能を付与するハニカム部であっても、ハニカム構造体1の軽量化、及び強度を考慮すると、それぞれ、セル密度を0.155~3.101セル/mm²(100~2000セル/平方インチ)、隔壁厚さを25~500μmとすることが好ましく、それぞれ、セル密度を0.236~3.101セル/mm²(150~2000セル/平方インチ)、隔壁

10 厚さを25~300μmとすることがより好ましい。また、貫通孔の径方向の断面形状としては、例えば、三角形、四角形、六角形、橢円形、又は円形等を挙げることができる。

【0039】図2に示すように、本発明においては、セル構造の異なる複数のハニカム部12、13は、必ずしも、異なる特性の材料からなる複数のハニカム部10、11に、対応して設ける必要はなく、セル構造の異なる複数のハニカム部10、11と、異なる特性の材料からなる複数のハニカム部12、13とを、それぞれ異なる20 部位で設けてもよい。

【0040】もっとも、各ハニカム部で求められる高い性能を発揮させるためには、図3に示すように、前述した異なる特性の材料からなる複数のハニカム部10、11に、実質的に対応させて、異なるセル構造の複数のハニカム部12、13を設けることが好ましい。

【0041】具体的には、異なる特性の材料からなる各ハニカム部10、11の境界と、異なるセル構造を設けた各ハニカム部12、13の境界との差が、10セル以内であることが好ましく、7セル以内であることがより好ましく、5セル以内であることが更に好ましく、3セル以内であることが特に好ましい。

【0042】本発明のハニカム構造体1においては、異なる特性の材料からなる複数のハニカム部10、11をどのような位置に設けるかについては特に制限はなく、求められる設計、性能等に応じて、適宜適切な位置に設ければよい。

【0043】例えば、図1に示すように、異なる特性の材料からなる複数のハニカム部10、11を、ハニカム構造体の中心軸を含む中央領域に設けられる、異なる40 特性の一の材料からなる第一のハニカム部11と、中央領域を包围して隣接する外周領域に設けられる、異なる特性の他の材料からなる第二のハニカム部10とにより構成させたものを挙げることができる。

【0044】また、図4に示すように、他の実施形態としては、異なる特性の材料からなる複数のハニカム部10、11を、ハニカム構造体1の中心軸と平行に略均等の間隔で位置する複数の円筒形状からなる領域に設けられる、異なる特性の一の材料からなる第一のハニカム部11と、この複数の円筒形状からなる領域を包围して50 隣接する外周領域に設けられる、異なる特性の他の材料

からなる第二のハニカム部10とにより構成させたものを挙げることができる。

【0045】更に他の実施形態としては、図5に示すように、ハニカム構造体1を軸方向に2分割した場合の、一方の領域に設けられる異なる特性の一の材料からなる第一のハニカム部11と、他方の領域に設けられる異なる特性の他の材料からなる第二のハニカム部10とにより構成されるもの；図6に示すように、ハニカム構造体1を軸方向に4分割した場合の、対角に位置する一対の領域にそれぞれ設けられる、異なる特性の一の材料からなる第一のハニカム部11と、異なる特性の他の材料からなる第二のハニカム部10とにより構成されるもの等を挙げることができる。

【0046】図1、4～6に示すように、本発明のハニカム構造体1は、上述した複数のハニカム部10、11が、それぞれ直接接合して一体化されているものである。

【0047】これにより、例えば、各ハニカム部10、11を同質の主結晶からなるものとすれば、接合部に集中する応力を低減して耐衝撃性、耐熱衝撃性等を向上させることができる。また、別々に製造したものを、寸法を合わせて接合するという必要がなく、製造工程を簡素化することができる。更に、接合部を要しない分、ハニカム構造体の有効断面積を増大させることができる。

【0048】なお、複数のハニカム部10、11を、直接接合して一体化する方法については、後述する本発明の製造方法で述べることとする。

【0049】本発明におけるハニカム構造体1では、求められる性能に応じて、上述した各ハニカム部10、11に種々の付加物を設けることが好ましい。

【0050】例えば、触媒担体としての性能を付与する場合であれば、その性能を付与するハニカム部10、11の隔壁3に、触媒能を有する金属を担持することが好ましく、この際、触媒能を有する金属としては、例えば、Pt、Pd、Rh等を挙げができる。

【0051】同様に、炭化水素等の吸着体としての性能を付与する場合には、その性能を付与するハニカム部10、11の隔壁3に、炭化水素等を吸着する吸着層を設けることが好ましい。この際、吸着層としては、例えば、ゼオライト、活性炭等からなる層を挙げることができ、中でも、耐熱性の点でゼオライトからなる層が好ましい。また、ゼオライトとしては、天然品、合成品何れのものでも用いることができるが、Si/A1モル比が、4.0以上のものが好ましく、例えば、ZSM-5、USY、β-ゼオライト、モルデナイト、シリカライト、メタロシリケート等を好適に挙げができる。なお、これらゼオライトは、種々の分子サイズの炭化水素等を吸着するためには、二種以上組合させて用いることが好ましい。

【0052】更に、フィルターとしての性能を付与する場合には、その性能を付与するハニカム部10、11の隔壁3を、前述した特性を有する材料からなる渦過能を有するものとし、この渦過能を有する隔壁により形成される貫通孔3を、貫通孔3が貫通する両端面で、所定の貫通孔については一方の端面で目封じし、残余の貫通孔については他方の端面で目封じしたものが好ましい。これにより、含塵流体中に含まれる粒子状物質を捕集・除去するフィルターとして用いることができる。

10 【0053】なお、本発明における各ハニカム部10、11は、これらの性能に限らず、その用途に応じて種々の性能を付与すればよいことは言うまでもない。

【0054】また、本発明のハニカム構造体1においては、構造体自体の形状については特に制限はなく、設計等に応じて、三角形、長方形、正方形、菱形、台形等の多角形、橢円、円形、トラックサークル形状、半橢円形、又は半円形等の形状を適用することができる。

20 【0055】次に、本発明のハニカム構造体の製造方法について説明する。本発明のハニカム構造体の製造方法は、セラミックス材料を主成分とする原料として、焼成後の特性が異なる複数の材料からなるものを用い、この複数の材料を、それぞれ異なる混練機構により、媒質と混練して複数の坯土を得、この複数の坯土を、それぞれ口金の異なる位置に導入した後、複数の坯土を同時に押出するものである。

【0056】このような本発明の製造方法によれば、焼成後の特性が異なる各ハニカム部を直接接合して一体化した本発明のハニカム構造体を、簡易且つ確実な工程により低コストで製造することができる。以下、具体的に説明する。

【0057】まず、本発明の製造方法では、セラミックス材料を主成分とする原料として、焼成後の特性が異なる複数の原料を用いる。

【0058】セラミックス材料を主成分とする原料としては、例えば、金属シリコン、炭化珪素、チタン、ジルコニアム、炭化ホウ素、炭化チタン、炭化ジルコニアム、窒化ケイ素、窒化ホウ素、窒化アルミニウム、酸化アルミニウム、酸化ジルコニアム、ムライト、コーディエライト化原料、チタン酸アルミニウム、サイアロン、カオリーン、タルク、水酸化アルミニウム、溶融シリカ、及び石英よりなる群から選ばれる少なくとも一の材料を主成分として含むものを挙げることができ、焼結後に、求められる性能に応じて、適宜選択すればよい。また、添加物として、結晶成長助剤、造孔材等の他の材料を更に含有させることにより、焼結後に、求められる性能に対応する原料としてもよい。なお、添加物として、分散剤、結合剤等を含有させてもよいことは言うまでもない。

50 【0059】セラミックス材料を主成分とする原料の焼成後の特性としては、例えば、気孔率、平均細孔径、

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吸水率、又は比熱等を挙げることができ、本発明では、これら特性の少なくとも1種で相違する原料を用いることが好ましい。これらの特性における所望の範囲は、本発明のハニカム構造体で示したものと同様であり、焼結後そのような特性が得られるように、原料を調製しておくことが好ましい。

【0060】 なお、触媒体、吸着体又はフィルターとして用いる部分の原料としては、コーディエライトやSiC等を主成分とするものを挙げることができる。

【0061】 本発明の製造方法では、次に、焼成後の特性が異なる材料を、それぞれ異なる混練機構により、媒質等と混練して複数の坯土を得る。

【0062】 本発明においては、混練機構について特に制限はなく、例えば、真空土練機を用いて混練してもよいが、後述するスクリュー式の押出し機構を用いて、混練工程と押出し工程を一連の工程で連続的に行なうことが生産性向上の点から好ましい。

【0063】 また、本発明においては、媒質について特に制限はなく、前述した原料等に応じて適宜好ましいものを用いればよい。

【0064】 本発明の製造方法では、次に、得られた焼成後の特性が異なる複数の坯土を、それぞれ口金の異なる位置に導入した後、複数の坯土を同時に押出して成形する。

【0065】 得られた焼成後の特性が異なる複数の坯土を、それぞれ口金の異なる位置に導入した後、同時に押出しする手段としては、焼成後の特性が異なる複数の坯土を一体化した複合坯土を作製し、この複合坯土を、押出し成形する方法を挙げができる。この際、この複合坯土は、例えば、図7に示すように、一の材料からなる一の坯土20の周囲に、一の坯土20とは焼成後の特性が異なる少なくとも1以上の他の坯土21を、配設して一体とすることにより得ることができる。このような複合坯土22では、1つのシリンジ式の押出し機構で、簡単に異なる特性の材料からなるハニカム部を直接接合したハニカム構造体を得ることができる。

【0066】 なお、前述した中央領域に設けられる第一のハニカム部と、外周領域に設けられる第二のハニカム部と、ハニカム構造体の中心軸を略同心とする位置で設ける場合には、一の材料からなる一の坯土20と、その周囲に設けられる一の坯土とは焼成後の特性が異なる材料からなる他の坯土21とを、略同心となる位置で設ければよい。

【0067】 また、本発明では、押出し成形によりハニカム構造体を製造するため、前述した複合坯土22は、押出し方向に対する垂直の方向に、焼成後の特性が異なる材料からなる各坯土20、21が、積層されていことが好ましい。また、押出し成形の際の成形性を向上させるためには、焼成後の特性が異なる複数の坯土20、21間の間隙を小さくして密接に接合させておくことが好ましい。

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とが好ましい。

【0068】 得られた異なる特性の材料からなる複数の坯土を、それぞれ口金の異なる位置に導入した後、同時に押出しする他の手段としては、焼成後の特性が異なる複数の坯土を、それぞれ異なる押出し機構により、口金の異なる位置に導入し、同時に押出しする方法を挙げができる。

【0069】 具体的には、図8(a)(b)に示すように、押出し機構として、複数のシリンジ式の押出し機構18、19を用い、焼成後の特性が異なる複数の坯土20、21を、各シリンジ式の押出し機構18、19内に投入し、各押出し機構18、19における押出し工程を同期させて行なうことにより、各坯土20、21を同時に押出しする方法、又は図9(a)(b)に示すように、押出し機構として、複数のスクリュー式の押出し機構16、17を用い、各押出し機構16、17における原料と媒質との混練の工程、及び混練により得られる坯土の押出しの工程を同期させて行なうことにより、各坯土20、21を同時に押出しする方法を挙げができる。

【0070】 中でも、原料と媒質との混練、及び混練により得られる坯土の押出しを連続的に行なうことができ、生産性を極めて高くすることができる点で、スクリュー式の押出し機構16、17を用いる後者の方法が好ましい。

【0071】 また、押出し機構の配置としては、例えば、図10(a)(b)に示すように、口金25における焼成後の特性が異なる各坯土を導入する各部位26、27毎に対応して、各押出し機構16、17を配設したものを挙げができる。もっとも、図9(a)(b)に示すように、少なくとも一の押出し機構17に、押出し機構17と口金25の特定の部位とを連通し、口金25の特定の部位に坯土を導入するガイド部28を設け、各押出し機構16、17を設計等に応じて自由に配設することも好ましい。なお、このガイド部28を設けた押出し機構17では、押出し機構自体の設計も極めて簡易なものとすることができる。

【0072】 本発明においては、用いる口金の形状及び構造について特に制限はないが、例えば、セル密度、隔壁厚さ、又は貫通孔の径方向における断面形状等のセル構造の異なる複数のハニカム部を設ける場合には、求められるセル構造に応じて、セルブロックピッチ、スリット幅、又はセルブロックの押出し方向に対する垂直方向の断面形状の少なくとも1種を相違させることが好ましい。

【0073】 また、異なる特性の材料からなる複数のハニカム部に略対応して、セル構造の異なる複数のハニカム部を設ける場合には、実質的に異なる特性の坯土が導入される部位毎にセル構造を相違させることができ

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【0074】具体的には、焼成後の特性が異なる坏土が導入される口金の各部位の境界と、異なる形状及び構造とした口金の各部位の境界との差が、10セル以内であることが好ましく、7セル以内であることがより好ましく、5セル以内であることが更に好ましく、3セル以内であることが特に好ましい。

【0075】本発明の製造方法では、通常、得られたハニカム構造の成形体を焼成することにより最終製品とする。焼成は、通常、マイクロ波及び／又は熱風等により成形体を乾燥した後、焼成することが好ましい。

【0076】

【実施例】以下、本発明を実施例により具体的に説明するが、本発明はこれら実施例に何ら限定されるものではない。なお、各実施例及び比較例で得られたハニカム構造体の評価は、以下の方法等により行った。

【0077】(評価方法)

1. 平均細孔径

マイクロメリティック社製の水銀圧入式ボロシメーターで測定した。

2. 気孔率

ハニカム構造体の構成材料の真比重と、全細孔容積から計算で求めた。また、細孔容積は、マイクロメリティック社製の水銀圧入式ボロシメーターで測定した。

3. 吸水率

JIS R2205 記載の方法により測定した。

【0078】(実施例及び比較例)

実施例1

まず、セラミックス原料として、それぞれ焼成後の特性が異なるコーディエライト化材料からなる第一のセラミックス原料と、第二のセラミックス原料とをそれぞれ調製した。

【0079】次いで、各セラミックス原料を、媒質として用いた水とともに、それぞれ異なる真空土練機に投入して、各セラミックス原料と水とを混練、成形し、直径150mmの円柱形状を有する第一のセラミックス原料からなる坏土と、幅47.5mm、厚さ40mmの平板状を有する第二のセラミックス原料からなる坏土を得た。

【0080】次いで、円柱形状を有する第一のセラミックス原料からなる坏土の周囲に、平板状を有する第二のセラミックス原料からなる坏土を巻き付けて一体化した複合坏土を作製した。

【0081】次いで、得られた円柱状の複合坏土を、直径120mmの中央部とその外周部で、セル構造の異なる口金を配設したラム式押出成形機に投入し、押出し成形を行った。

【0082】次いで、得られた成形体を熱風及びマイクロ波により乾燥後、第一のセラミックス原料からなるハニカム部の貫通孔を、貫通する両端面で互い違いに目封じし、焼成した後、第二のセラミックス原料からなる

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ハニカム部の隔壁にPtを主成分とする触媒を担持して、長さ203mm、直径190mmの円柱状であり、第一のセラミックス原料からなるハニカム部が、ハニカム構造体と同心の直径120mmの円柱形状領域で設けられているハニカム構造体を得た。

【0083】得られたハニカム構造体の特性を調査したところ、第一のセラミックス原料からなるハニカム部では、平均細孔径30μm、吸水率91%、気孔率70%、隔壁厚さ0.25mm、セル密度0.465セル/mm²(300セル/平方インチ)、貫通孔の径方向の断面形状が四角形であり、第二のセラミックス原料からなるハニカム部では、平均細孔径5μm、吸水率17%、気孔率30%、隔壁厚さ0.1mm、セル密度0.930セル/mm²(600セル/平方インチ)、貫通孔の径方向の断面形状四角形であった。

【0084】また、図11に示すように、このハニカム構造体1をメタルケース40に把持し、2400ccのディーゼルエンジンの排気管41を第一のセラミックス原料からなる第一のハニカム部11に対応させて配設し、排ガス浄化装置を作製した。

【0085】排ガスを、排気管41の外壁と、メタルケースの内壁で形成される排ガス導入路39から導入して、第二のセラミックス原料からなりNOをNO₂に変換する触媒体として機能する第二のハニカム部10と、第一のセラミックス原料からなり粒子状物質を捕集・除去するフィルターとして機能する第一のハニカム部11とを順に経由させて排ガスを浄化したところ、優れた排ガス浄化性能が認められた。また、試験後のハニカム構造体について、損傷、変形等を確認したところ、両ハニカム部の接合部を含め、剥離、亀裂等の損傷、及び貫通孔の変形等は全く認められなかった。なお、図11中の矢印は、排ガスの進行方向を示す。

【0086】実施例2

まず、セラミックス原料として、それぞれ焼成後の特性が異なる炭化珪素材料からなる第一のセラミックス原料と第二のセラミックス原料とをそれぞれ調製した。

【0087】次いで、第一のセラミックス原料を押出しする一のスクリュー式押出し機構が、口金の入口端面の中心点と同心の直径90mmの中央部に対応して設けられ、第二のセラミックス原料を押出しする他のスクリュー式押出し機構が、前述した口金の中央部と同心の外周部に連通するガイド部を有する押出し成形装置を行い、各セラミックス原料を、媒質とともに、それぞれ異なるスクリュー式押出し機構に投入して、混練、及び得られる各坏土の押出し成形を各押出し機構で同期させて行い、ハニカム構造の成形体を作製した。この際、口金としては、中央部と外周部でセル構造の異なるものを用いた。

【0088】次いで、得られた成形体をマイクロ波により乾燥後、第一のセラミックス原料からなるハニカム

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部の貫通孔を、貫通する両端面で互い違いに目封じした後、焼成した。その後、第二のセラミックス原料からなるハニカム部の隔壁にPtを主成分とする触媒を担持して、第一のセラミックス原料からなるハニカム部が、ハニカム構造体と同心の直径90mmの円柱形状領域で設けられている長さ152mm、直径144mmの円柱状のハニカム構造体を得た。

【0089】 得られたハニカム構造体の特性を調査したところ、第一のセラミックス原料からなるハニカム部では、平均細孔径10μm、気孔率45%、吸水率27%、隔壁厚さ0.3mm、セル密度0.310セル/mm²(200セル/平方インチ)、貫通孔の径方向の断面形状四角形であり、第二のセラミックス原料からなるハニカム部では、平均細孔径4μm、気孔率20%、吸水率9%、隔壁厚さ0.15mm、セル密度0.620セル/mm²(400セル/平方インチ)、貫通孔の径方向の断面形状は六角形であった。

【0090】 また、図11に示すように、このハニカム構造体1を、メタルケース40に把持し、2400ccのディーゼルエンジンの排気管41を第一のセラミックス原料からなる第一のハニカム部11に対応させて配設し、排ガス浄化装置を作製した。

【0091】 排ガスを、排気管41の外壁と、メタルケースの内壁で形成される排ガス導入路39から導入して、第二のセラミックス原料からなりNOをNO₂に変換する触媒体として機能する第二のハニカム部10と、第一のセラミックス原料からなり粒子状物質を捕集・除去するフィルターとして機能する第一のハニカム部11とを順に経由させて排ガスを浄化したところ、優れた排ガス浄化性能が認められた。また、試験後のハニカム構造体について、損傷、変形等を確認したところ、両ハニカム部の接合部を含め、剥離、亀裂等の損傷、及び貫通孔の変形等は全く認められなかった。なお、図11中の矢印は、排ガスの進行方向を示す。

【0092】 実施例3

まず、セラミックス原料として、それぞれ焼成後の特性が異なるコーディエライト化材料からなる第一のセラミックス原料と、第二のセラミックス原料とをそれぞれ調製した。

【0093】 次いで、第一のセラミックス原料を押出しする一のスクリュー式の押出し機構を口金の中央部に対応して配設し、第二のセラミックス原料を押出しする複数のスクリューを有する他のスクリュー式押出し機構を、一のスクリュー式押出し機構の外周部に配設した押出し成形装置を用い、各セラミックス原料を、それぞれ異なるスクリュー式押出し機構に投入して、各セラミックス原料の混練、及び得られる各坏土の押出しを、各押出し機構で同期させて行いハニカム構造の成形体を作製した。この際、口金としては、中央部と外周部でセル構造の異なるものを用いた。

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【0094】 次いで、得られた成形体を乾燥、焼成した後、第二のセラミックス原料からなるハニカム部の隔壁には、Pt及びPdを主成分とする触媒を担持し、第一のセラミックス原料からなるハニカム部の隔壁には、ゼオライトZSM-5(The PQ(株)社製)を主成分とする吸着層を設け、第一のセラミックス原料からなるハニカム部が、ハニカム構造体と同心の直径45mmの円柱形状領域で設けられている長さ152mm、直径144mmの円柱状のハニカム構造体を得た。

【0095】 得られたハニカム構造体の特性を調査したところ、第一のセラミックス原料からなるハニカム部では、平均細孔径3μm、吸水率10%、気孔率20%、隔壁厚さ150μm、0.620セル/mm²(セル密度400セル/平方インチ)、貫通孔の径方向の断面形状三角形であり、第二のセラミックス原料からなるハニカム部では、平均細孔径7μm、吸水率22%、気孔率35%、隔壁厚さ100μm、セル密度0.465セル/mm²(300セル/平方インチ)、貫通孔の径方向の断面形状が六角形であった。

【0096】 また、このハニカム構造体を、メタルケースに把持し、3000ccのガソリンエンジンの排気管を、ハニカム構造体の一の端面に対応して配設し、排ガス浄化装置を作製した。

【0097】 排ガスを、第二のセラミックス原料からなりHC、CO、NO_xを酸化還元する三元触媒体として機能する第二のハニカム部と、第一のセラミックス原料からなり炭化水素成分を吸着する吸着体として機能する第一のハニカム部とに導入して、排ガスを浄化したところ、優れた排ガス浄化性能が認められた。また、試験後のハニカム構造体について、損傷、変形等を確認したところ、両ハニカム部の接合部を含め、剥離、亀裂等の損傷、及び貫通孔の変形等は全く認められなかった。

【0098】 比較例1

セラミックス原料として、焼成後の特性が同一の一種類のコーディエライト化材料からなる原料を用いたこと、及び口金として、全体に、同一のセル構造を有するものを用いたこと以外は実施例1と同様にして、長さ203mm、直径190mmの円柱状のハニカム構造体を得た。

【0099】 得られたハニカム構造体の特性を調査したところ、ハニカム構造体全体で、平均細孔径7μm、吸水率22%、気孔率35%、隔壁厚さ0.25mm、セル密度0.465セル/mm²(300セル/平方インチ)、貫通孔の径方向の断面形状が四角形であった。

【0100】 また、図11に示すように、このハニカム構造体1をメタルケース40に把持し、2400ccのディーゼルエンジンの排気管41を第一のセラミックス原料からなる第一のハニカム部11に対応させて装着し、排ガス浄化装置を作製した。

【0101】 排ガスを、排気管41の外壁と、メタル

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ケースの内壁で形成される排ガス導入路39から導入して、NOをNO₂に変換する触媒体として機能させた第二のハニカム部10と、粒子状物質を捕集・除去するフィルターとして機能させた第一のハニカム部11とを順に経由させて排ガスを浄化したところ、フィルターとして機能させた第一のハニカム部11の圧損が、実施例1のハニカム構造体に比べ3倍以上大きくなり、排ガス浄化装置として充分機能しなかった。なお、図11中の矢印は、排ガスの進行方向を示す。

【0102】

【発明の効果】 以上説明したように、本発明によれば、各ハニカム部毎に要求に応じた異なる高い性能を発揮することができ、しかも、各ハニカム部の形状不整合や接合材の存在による局所的な応力集中がなく、使用時等の信頼性の高い、特に、排ガス浄化システム、熱交換器、固体電解質電池、音響波動冷却装置等の熱音響機関等に好適なハニカム構造体を提供することができる。また、本発明は、このような優れた特性を有するハニカム構造体を、簡易且つ確実な行程により低成本で製造することができる製造方法を提供することができる。

【図面の簡単な説明】

【図1】 本発明のハニカム構造体における一の実施形態を模式的に示す斜視図である。

【図2】 本発明のハニカム構造体において、異なる特性の材料からなる複数のハニカム部と、セル構造の異なるハニカム部との配置関係の一例を模式的に示す平面図である。

【図3】 本発明のハニカム構造体において、異なる特性の材料からなる複数のハニカム部と、セル構造の異なるハニカム部との配置関係の他の例を模式的に示す平面図である。

【図4】 本発明のハニカム構造体における他の実施形態を模式的に示す斜視図である。

【図5】 本発明のハニカム構造体における更に他の実

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施形態を模式的に示す斜視図である。

【図6】 本発明のハニカム構造体における更に他の実施形態を模式的に示す斜視図である。

【図7】 本発明のハニカム構造体の製造方法において、複合坯土を作製する方法の一例を模式的に示す工程図である。

【図8】 (a)は、本発明のハニカム構造体の製造方法において用いられる押出し機構の一例を模式的に示す一部断面図であり、(b)は、(a)のガイド部の配置を示すAの位置での一部断面図である。

【図9】 (a)は、本発明のハニカム構造体の製造方法において用いられる押出し機構の他の例を模式的に示す一部断面図であり、(b)は、(a)のガイド部の配置を示すBの位置での一部断面図である。

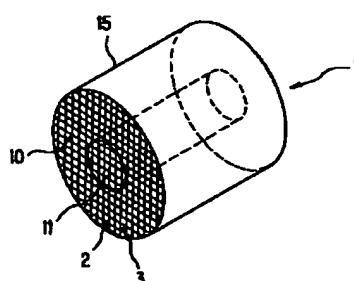
【図10】 (a)は、本発明のハニカム構造体の製造方法において用いられる押出し機構の更に他の例を模式的に示す一部断面図であり、(b)は、(a)のガイド部の配置を示すCの位置での一部断面図である。

【図11】 本発明の実施例又は比較例におけるハニカム構造体を、ディーゼルエンジンの排気管に装着した排ガス浄化装置を示す半断面図である。

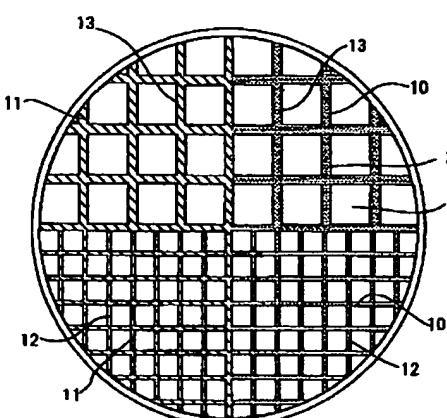
【符号の説明】

1…ハニカム構造体、2…隔壁、3…貫通孔、10、11…異なる特性の材料からなるハニカム部（10…第二のハニカム部、11…第一のハニカム部）、12、13…セル構造の異なるハニカム部、16、17…押出し機構（スクリュー式押出し機構）、16a、17a…スクリュー、18、19…押出し機構（シリング式押出し機構）、18a、19a…ピストン、20…一の坯土、21…他の坯土、25…口金、26、27…口金の各坯土を導入する部位、28…ガイド部、31…ハニカム構造体（焼成前）、39…排ガス導入路、40…メタルケース、41…排気管。

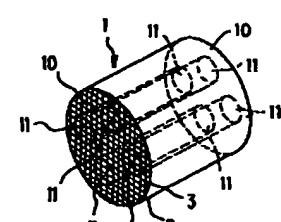
【図1】



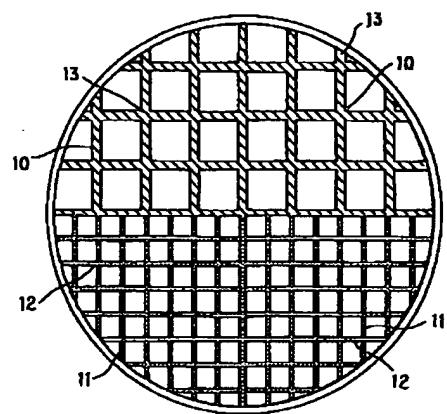
【図2】



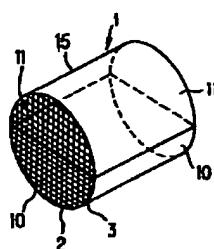
【図4】



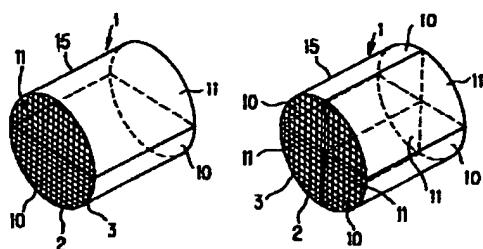
【図3】



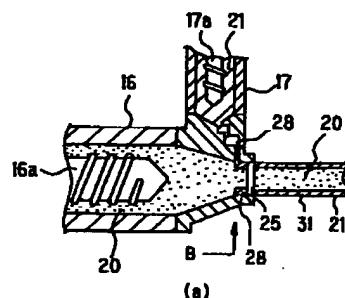
【図5】



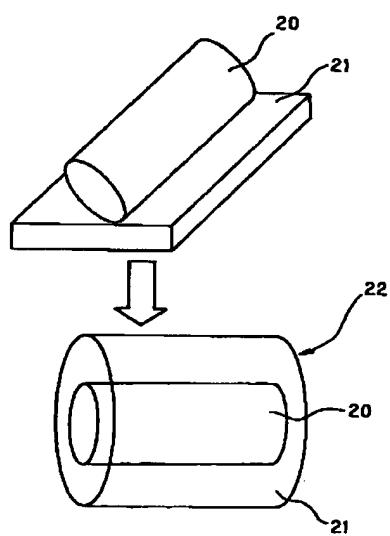
【図6】



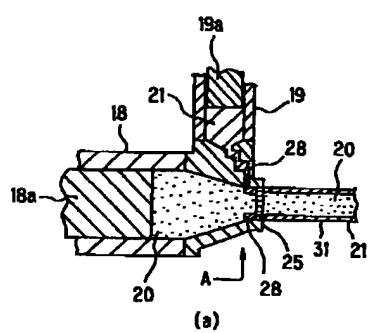
【図9】



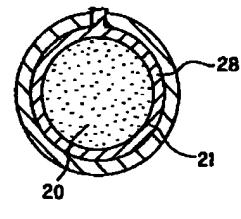
【図7】



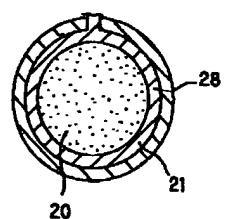
【図8】



(a)

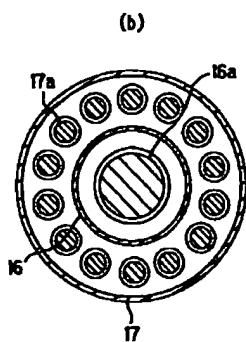
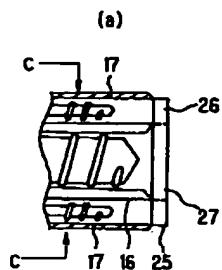


(b)

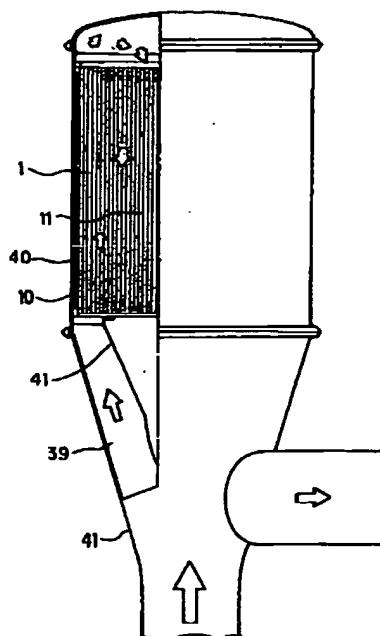


(b)

【図10】



【図11】



【手続補正書】

【提出日】平成14年7月15日(2002.7.15)

【手続補正1】

【補正対象書類名】明細書

【補正対象項目名】請求項9

【補正方法】変更

【補正内容】

【請求項9】 該複数のハニカム部が、0.155～3.101セル/mm²(100～2000セル/平方インチ)のセル密度を有する請求項1～8のいずれか一項に記載のハニカム構造体。

【手続補正2】

【補正対象書類名】明細書

【補正対象項目名】請求項10

【補正方法】変更

【補正内容】

【請求項10】 該複数のハニカム部の隔壁が、25～500μmの厚さを有する請求項1～9のいずれか一項に記載のハニカム構造体。

【手続補正3】

【補正対象書類名】明細書

【補正対象項目名】請求項19

【補正方法】変更

【補正内容】

【請求項19】 該複数の坯土を、それぞれ異なる押出し機構により、口金の異なる位置に導入して、同時に押し出すする請求項16に記載のハニカム構造体の製造方法。

【手続補正4】

【補正対象書類名】明細書

【補正対象項目名】0054

【補正方法】変更

【補正内容】

【0054】 また、本発明のハニカム構造体1においては、構造体自体の形状については特に制限はなく、設計等に応じて、三角形、長方形、正方形、菱形、台形等の多角形、橢円、円形、レーストラック形状、半橢円形、又は半円形等の形状を適用することができる。

【手続補正5】

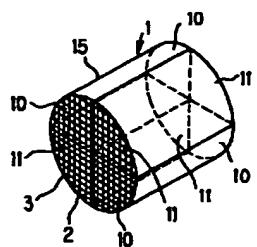
【補正対象書類名】図面

【補正対象項目名】図6

【補正方法】変更

【補正内容】

【図6】



フロントページの続き

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* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to a honeycomb structure object. It consists of two or more ingredients of a different property in more detail, and it is the honeycomb structure object which has two or more different functions for every specific part, and is especially related with the suitable honeycomb structure object for heat sound engines, such as an emission-gas-purification system, a heat exchanger, a solid electrolyte cell, and a sound wave-motion cooling system, etc.

[0002]

[Description of the Prior Art] About an emission-gas-purification means, the catalyst object which supported the metal which has a catalyst function is conventionally used for the septum of ** honeycomb structure object. The through tube which is made to constitute the septum of an emission-gas-purification means to decompose components, such as a hydrocarbon in exhaust gas, a carbon monoxide, or nitrogen oxides, by the oxidation reduction reaction, and ** honeycomb structure object, with a porous material, and is formed by the septum in respect of the both ends to penetrate By considering as the structure which ******(ed) by one end face about the predetermined through tube, and ******(ed) in respect of the other end about the residual through tube The adsorption layer which becomes the septum of uptake, the emission-gas-purification means to remove, and ** honeycomb structure object from a zeolite, activated carbon, etc. by the septum about the particulate matter in exhaust gas is prepared, and various attempts, such as an emission-gas-purification means to adsorb and remove the hydrocarbon component in exhaust gas etc., are made.

[0003] Moreover, with exhaust gas toughening of regulations etc., the higher purification engine performance is called for and the emission-gas-purification system which combined a different emission-gas-purification means mentioned above as one of the attempts according to the request is developed in recent years.

[0004] For example, the honeycomb structure object which joined the honeycomb structure object and the bell shape honeycomb structure object of the shape of a cylinder of different septum thickness and a cel consistency to JP,7-232084,A with the ceramic jointing material for corrugated fibreboard is indicated.

[0005] However, with this honeycomb structure object, separately, both configuration was made to agree in a precision and, moreover, each honeycomb structure object needed to be manufactured. For this reason, while the production process became complicated and the manufacturing cost became high, it was easy to produce the slack of the joint resulting from the mismatching of both configuration, a blank, etc.

[0006] Moreover, with this honeycomb structure object, it was easy to concentrate stress on a joint, and there was a problem of being easy to produce the slack of a joint, a blank, etc., by a mechanical shock, thermal impacts, etc. in the case, such as transportation between processes, grant of a catalyst or adsorption material, canning, or real use.

[0007] On the other hand, the honeycomb structure object with which the catalyst object and the filter are directly united with WO01/04466 official report is indicated.

[0008] However, the present condition was constituted from this honeycomb structure object by the ingredient which has the same property with the whole honeycomb structure object, although the catalyst object's differed in the engine performance called for greatly from the filter, since the technique of manufacturing to coincidence what consists of an ingredient of a different property about the honeycomb structure object of the quality of the ceramics in one was not developed conventionally.

[0009] That is, although the point that the optimal ingredient constituted from this honeycomb structure object

according to the engine performance called for as a catalyst object and a filter was not taken into consideration at all but made the function as a catalyst object and a filter have, they were not a catalyst object and the thing which can fully demonstrate the original engine performance called for as a filter.

[0010]

[Problem(s) to be Solved by the Invention] This invention is made in view of an above-mentioned technical problem, can demonstrate different high engine performance according to a demand for every honeycomb section, moreover, does not have concentration of the local stress by existence of the configuration mismatching of each honeycomb section or a jointing material for corrugated fibreboard, and aims at offering a reliable honeycomb structure object in the cases at the time of use etc. Moreover, this invention aims at offering the manufacture approach that the honeycomb structure object which has such an outstanding property can be manufactured by low cost according to a simple and positive stroke.

[0011]

[Means for Solving the Problem] He completed the header and the honeycomb structure object of this invention for the problem mentioned above being solvable by joining each honeycomb section directly, without minding a jointing material for corrugated fibreboard while he constituted with the ingredient of a different property according to the engine performance called for for each [have a different function] honeycomb section of every, when the artificer of this invention inquired wholeheartedly that the above-mentioned purpose should be attained. Moreover, the artificer of this invention completed the header and the manufacture approach of this invention for the ability of such a honeycomb structure object to be manufactured simply and certainly by carrying out extrusion molding of two or more plastic matters which consist of an ingredient with which the properties after baking differ to coincidence.

[0012] That is, the honeycomb structure object which according to this invention is a honeycomb structure object by which two or more through tubes are formed in shaft orientations by two or more septa, and is characterized by being constituted by two or more honeycomb sections which consist of an ingredient of the property that honeycomb structure objects differ, and for these two or more honeycomb sections joining directly, and unifying them, respectively is offered.

[0013] It is desirable that the honeycomb section of ** two [consisting of the ingredient of everything but a property / differing / preparing in a periphery / surrounding a central field and adjoining the honeycomb section of ** one / consisting of the ingredient of one of a property / differing / preparing two or more honeycomb / consisting of an ingredient / section in a central / including the medial axis of a honeycomb structure object / field / field] of a property [differing in this invention] constitutes.

[0014] Moreover, in this invention, it is desirable that the ingredient which constitutes two or more honeycomb sections is different in porosity, average pore size, or at least one sort of properties of water absorption. Under the present circumstances, as for the ingredient which constitutes two or more honeycomb sections, it is desirable that porosity is 5 - 80%, it is desirable that average pore size is 0.5-100 micrometers, and it is desirable that water absorption is 1 - 95%.

[0015] Moreover, in this invention, it is also desirable to constitute a honeycomb structure object further by two or more honeycomb sections which are different among that cellular structure in at least one sort of a cel consistency, septum thickness, or the cross section configuration of the direction of a path in a through tube, and it is desirable that two or more honeycomb sections from which the cellular structure is different are prepare substantially corresponding to two or more honeycomb sections which consist of an ingredient of a different property in this case.

[0016] In this invention, as for two or more honeycomb sections from which the cellular structure is different, it is desirable to have 0.155 to 3.101 cel / cel consistency of mm² (100-2000 cel / square inch), and it is desirable to have the septum thickness which is 25-500 micrometers.

[0017] In addition, in this invention, at least one sort chosen from the group which consists of cordierite, silicon carbide, silicon nitride, an alumina, a mullite, lithium aluminium silicate, aluminum titanate, and a zirconia as an ingredient which constitutes two or more honeycomb sections can be used.

[0018] Moreover, in this invention, if the engine performance as a catalyst object is given If the engine performance as adsorbent is given to the septum of a part of [at least] honeycomb sections that what is necessary is just to support the metal which has catalyst ability If uptake and the engine performance as a filter to remove are given, the particulate matter contained in the septum of a part of [at least] honeycomb sections in dust-containing fluid that what is necessary is just to prepare the adsorption layer which has hydrocarbon adsorption capacity What is necessary is to make the septum which has filtration ability constitute a part of [at least] honeycomb sections, to stop one edge about

a through tube predetermined in the both-ends side where a through tube penetrates the through tube formed by the septum which has this filtration ability, to stop the other-end section and just to ***** about a residual through tube. [0019] On the other hand, according to this invention, it is. The raw material which uses a ceramic ingredient as a principal component, As a raw material which is the manufacture approach of the honeycomb structure object which kneads a medium, obtains a plastic matter and carries out extrusion molding of this plastic matter, and uses a ceramic ingredient as a principal component Two or more of these raw materials are kneaded with a medium at kneading-machine guard different, respectively using two or more raw materials with which the properties after baking differ. Two or more plastic matters from which the property after baking differs are obtained, and the manufacture approach of the honeycomb structure object characterized by extruding and making them into coincidence after introducing two or more of these plastic matters into the location where mouthpieces differ, respectively is offered.

[0020] The approach of introducing into a mouthpiece the compound plastic matter which made two or more plastic matters one as a means which extrudes and makes them coincidence in the manufacture approach of this invention after introducing two or more plastic matters into the location where mouthpieces differ, respectively, and extruding and making two or more plastic matters coincidence is desirable.

[0021] Under the present circumstances, a compound plastic matter has the desirable thing which comes to arrange other at least one or more plastic matters in which the property after baking differs from the plastic matter of 1 in the perimeter of the plastic matter of 1 which consists of an ingredient of 1.

[0022] Moreover, the approach of carrying out extrusion molding of them to coincidence by extruder style different, respectively, as other means which extrude and make them coincidence in the manufacture approach of this invention after introducing two or more plastic matters into the location where mouthpieces differ, respectively, after introducing two or more plastic matters into the location where mouthpieces differ is also desirable.

[0023] Under the present circumstances, although the extruder style of a syringe type may be used as an extruder style, it is desirable by considering as the extruder style of a screw type to perform continuously extrusion of the plastic matter obtained by kneading with the raw material and medium which use a ceramic ingredient as a principal component, and kneading according to a series of processes.

[0024] Moreover, in the manufacture approach of this invention, it is desirable that the raw material which uses a ceramic ingredient as a principal component is different in the property after baking chosen from at least one sort of porosity, average pore size, or water absorption.

[0025] Moreover, it is also desirable to use the thing into which the plastic matter of the property that at least one sorts of a cell block pitch, slit width, or the vertical cross-section configuration over the direction of extrusion of a cell block differ as a mouthpiece is introduced and which is substantially different for every part.

[0026]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained concretely, referring to a drawing.

[0027] As shown in drawing 1, by two or more septa 2, two or more through tubes 3 are formed in shaft orientations, and the honeycomb structure object 1 of this invention is constituted by two or more honeycomb sections 10 and 11 which consist of an ingredient of the property that the honeycomb structure objects 1 differ, and two or more honeycomb sections 10 and 11 of a parenthesis join directly, respectively, and it is unified.

[0028] The high engine performance from which each honeycomb sections 10 and 11 differ by this according to the engine performance called for can be demonstrated, moreover, there is no local stress concentration by existence of the configuration mismatching of each honeycomb sections 10 and 11 and a jointing material for corrugated fibreboard, and the dependability in the time of use etc. can be raised. Hereafter, it explains concretely.

[0029] In this invention, at least one sort chosen from the group which consists of cordierite, metal silicon, silicon carbide, silicon nitride, an alumina, a mullite, lithium aluminium silicate, aluminum titanate, and a zirconia as an ingredient which constitutes two or more honeycomb sections 10 and 11 can be mentioned.

[0030] Moreover, it is desirable to be able to mention porosity, average pore size, water absorption, or the specific heat, and to differ in this invention as a property of the ingredient which constitutes the honeycomb sections 10 and 11, according to the engine performance asked for at least one sort of these properties in each honeycomb sections 10 and 11, for example.

[0031] For example, in the honeycomb section 10 used as a catalyst object or adsorbent, it is more desirable that it is desirable to make average pore size to 1-80 micrometers, and to make water absorption into 1 - 40% for porosity 20 to

40%, and make average pore size to 1-60 micrometers, and it makes water absorption 4 - 35% for porosity 25 to 35%. [0032] Moreover, it is more desirable that it is desirable to set porosity and to set average pore size to 5-45 micrometers 40 to 80% in the honeycomb section 11 used as a filter, and set porosity and it sets average pore size to 10-40 micrometers 40 to 70%, for example.

[0033] Moreover, even if it is the honeycomb sections 10 and 11 which give what kind of engine performance, when lightweight-izing of the honeycomb structure object 1 and reinforcement are taken into consideration, it is more desirable that it is desirable respectively to make average pore size to 0.5-100 micrometers, and to make water absorption into 1 - 95% for porosity 5 to 80%, and make average pore size to 1-60 micrometers, and it makes water absorption 4 - 92% for porosity 25 to 70%, respectively.

[0034] Though the material properties of each honeycomb sections 10 and 11 were made to differ and the same ingredient is made to constitute each honeycomb sections 10 and 11 by making it constitute with each honeycomb section 10 and a different ingredient for every 11, material properties were made to differ in this invention. As a case of the latter, it can consider as such a honeycomb structure object by being able to mention the thing which made porosity differ from pore size etc., for example, adding a crystal growth assistant, ostomy material, etc. in a raw material, for example, making it constitute from an ingredient of the same class.

[0035] Two or more honeycomb sections 12 and 13 from which at least one sort in the cellular structure, such as a cel consistency, septum thickness, or a cross-section configuration of the direction of a path in a through tube, differs can also be made to constitute further in the honeycomb structure object 1 of this invention according to the engine performance of each honeycomb sections 12 and 13 called for, as shown in drawing 2 and drawing 3.

[0036] for example, in the honeycomb section used as a catalyst object or adsorbent A cel consistency, respectively 0.465 to 3.101 cel / mm² (300-2000 cel / square inch), The cross-section configuration of the direction [in / for septum thickness / 25-300 micrometers and a through tube] of a path A triangle, It is desirable a square, a hexagon, or to suppose that it is circular, and it is more desirable to set 0.930 to 3.101 cel / mm² (600-2000 cel / square inch), and septum thickness to 25-100 micrometers for a cel consistency, respectively.

[0037] moreover, for example, in the honeycomb section used as a filter A cel consistency, respectively 0.155 to 0.620 cel / mm² (100-400 cel / square inch), The cross-section configuration of the direction [in / for septum thickness / 100-500 micrometers and a through tube] of a path A triangle, Considering as a square or a hexagon is desirable, and it is more desirable respectively to use the cross-section configuration of the direction [in / for 0.236 to 0.465 cel / mm² (150-300 cel / square inch), and septum thickness / in a cel consistency / 200-300 micrometers and a through tube] of a path as a square.

[0038] Moreover, if lightweight-izing of the honeycomb structure object 1 and reinforcement are taken into consideration even if it is the honeycomb section which gives what kind of engine performance A cel consistency, respectively 0.155 to 3.101 cel / mm² (100-2000 cel / square inch), It is desirable to set septum thickness to 25-500 micrometers, and it is more desirable respectively to set 0.236 to 3.101 cel / mm² (150-2000 cel / square inch), and septum thickness to 25-300 micrometers for a cel consistency. Moreover, as a cross-section configuration of the direction of a path of a through tube, a triangle, a square, a hexagon, an ellipse form, or a round shape can be mentioned, for example.

[0039] It is not necessary to necessarily form two or more honeycomb sections 12 and 13 from which the cellular structure differs in this invention as shown in drawing 2 corresponding to two or more honeycomb sections 10 and 11 which consist of an ingredient of a different property, and they may form two or more honeycomb sections 10 and 11 from which the cellular structure differs, and two or more honeycomb sections 12 and 13 which consist of an ingredient of a different property by part different, respectively.

[0040] But in order to demonstrate the high engine performance called for in each honeycomb section, as shown in drawing 3, it is desirable to form two or more honeycomb sections 12 and 13 of the cellular structure which is made to correspond to two or more honeycomb sections 10 and 11 which consist of an ingredient of a different property mentioned above substantially, and is different.

[0041] It is more desirable that they are less than seven cels, it is desirable that the difference of the boundary of each honeycomb sections 10 and 11 which specifically consists of an ingredient of a different property, and the boundary of each honeycomb sections 12 and 13 which established the different cellular structure is less than ten cels, and it is [it is still more desirable that they are less than five cels, and] desirable that they are especially less than three cels.

[0042] What is necessary is for there to be especially no limit and just to prepare it in a suitable location suitably in the

honeycomb structure object 1 of this invention, according to a design, engine performance, etc. which are called for about in what kind of location two or more honeycomb sections 10 and 11 which consist of an ingredient of a different property are formed.

[0043] For example, a thing [making the honeycomb section 10 of ** two / consisting of the ingredient of everything but a property / differing / preparing in a periphery / surrounding and adjoining / field / constitute the honeycomb section 11 of ** one / consisting of the ingredient of one of a property / differing / preparing two or more honeycomb / consisting of an ingredient / sections 10 and 11 of a property / differing, as showing in drawing 1 / in a central / including the medial axis of a honeycomb structure object / field /, and a central field] can mention.

[0044] As shown in drawing 4, moreover, as other operation gestalten The first honeycomb section 11 which is prepared in the field which consists two or more honeycomb sections 10 and 11 which consist of an ingredient of a different property of two or more shape of a cylindrical shape located in the medial axis of the honeycomb structure object 1, and parallel at spacing with an equal abbreviation and which consists of an ingredient of 1 of a different property, The thing which made the field which consists of two or more shape of this cylindrical shape constitute by the second honeycomb section 10 which is prepared in the periphery field which surrounds and adjoins, and which consists of other ingredients of a different property can be mentioned.

[0045] Furthermore, the first honeycomb section 11 which consists of an ingredient of 1 of a different property prepared in one field at the time of dividing the honeycomb structure object 1 into two at shaft orientations as other operation gestalten as shown in drawing 5, What is constituted by the second honeycomb section 10 which consists of other ingredients of a different property prepared in the field of another side; as shown in drawing 6 What is constituted by the first honeycomb section 11 which is prepared in the field of the pair located in the vertical angle at the time of quadrisectioning the honeycomb structure object 1 into shaft orientations, respectively, and which consists of an ingredient of 1 of a different property, and the second honeycomb section 10 which consists of other ingredients of a different property can be mentioned.

[0046] As shown in drawing 1, and 4-6, two or more honeycomb sections 10 and 11 mentioned above join the honeycomb structure object 1 of this invention directly, respectively, and it is unified.

[0047] The stress which concentrates each honeycomb sections 10 and 11 on the thing which consists of the homogeneous main crystal, then a joint by this can be reduced, and shock resistance, thermal shock resistance, etc. can be raised. Moreover, what was manufactured separately does not need to be referred to as doubling a dimension and joining, and a production process can be simplified. Furthermore, the effective sectional area of the part which does not require a joint, and a honeycomb structure object can be increased.

[0048] In addition, suppose that it states by the manufacture approach of this invention mentioned later about the approach of joining two or more honeycomb sections 10 and 11 directly, and unifying.

[0049] It is desirable to prepare various addition products in each honeycomb sections 10 and 11 mentioned above with the honeycomb structure object 1 in this invention according to the engine performance called for.

[0050] For example, if it is the case where the engine performance as catalyst support is given, and it will be desirable to support the metal which has catalyst ability to the septum 3 of the honeycomb sections 10 and 11 which give that engine performance and it will have and carry out the metal of the catalyst ability to it in this case, Pt, Pd, Rh, etc. can be mentioned, for example.

[0051] Similarly, when giving the engine performance as adsorbent, such as a hydrocarbon, it is desirable to prepare the adsorption layer which adsorbs a hydrocarbon etc. in the septum 3 of the honeycomb sections 10 and 11 which give the engine performance. Under the present circumstances, the layer which can mention the layer which consists of a zeolite, activated carbon, etc. as an adsorption layer, for example, and consists of a zeolite in respect of thermal resistance especially is desirable. moreover -- as a zeolite -- a natural article and synthetic compounds -- although anything can be used, a Si/aluminum mole ratio has 40 or more desirable things, for example, can mention ZSM-5, USY, beta-zeolite, mordenite, Silicalite, metallosilicate, etc. suitably. In addition, in order to adsorb the hydrocarbon of various molecule sizes etc., as for these zeolites, it is desirable to combine two or more sorts and to use.

[0052] furthermore, in giving the engine performance as a filter The through tube 3 formed by the septum which shall have the filtration ability which consists of an ingredient which has the property which mentioned above the septum 3 of the honeycomb sections 10 and 11 which give that engine performance, and has this filtration ability in respect of the both ends which a through tube 3 penetrates What ***** (ed) by one end face about the predetermined through tube, and ***** (ed) in respect of the other end about the residual through tube is desirable. Thereby, the particulate matter

contained in dust-containing fluid can be used as uptake and a filter to remove.

[0053] In addition, it cannot be overemphasized that each honeycomb sections 10 and 11 in this invention should just give various engine performance not only according to these engine performance but according to its application.

[0054] Moreover, in the honeycomb structure object 1 of this invention, there is especially no limit about the configuration of the structure itself, and configurations, such as polygons, such as a triangle, a rectangle, a square, a rhombus, and a trapezoid, an ellipse, circular, a truck circle configuration, a half-ellipse form, or a hemicycle, can be applied according to a design etc.

[0055] Next, the manufacture approach of the honeycomb structure object of this invention is explained. By kneading-machine style which is different in two or more of these ingredients using what consists of two or more ingredients with which the properties after baking differ as a raw material which uses a ceramic ingredient as a principal component, respectively, after kneading the manufacture approach of the honeycomb structure object of this invention with a medium, obtaining two or more plastic matters and introducing two or more of these plastic matters into the location where mouthpieces differ, respectively, it extrudes two or more plastic matters to coincidence, and it carries out.

[0056] According to the manufacture approach of such this invention, the honeycomb structure object of this invention which joined directly each honeycomb section from which the property after baking differs, and was unified can be manufactured by low cost according to a simple and positive process. Hereafter, it explains concretely.

[0057] First, by the manufacture approach of this invention, two or more raw materials with which the properties after baking differ are used as a raw material which uses a ceramic ingredient as a principal component.

[0058] As a raw material which uses a ceramic ingredient as a principal component For example, metal silicon, silicon carbide, titanium, a zirconium, boron carbide, Titanium carbide, zirconium carbide, silicon nitride, boron nitride, aluminum nitride, An aluminum oxide, a zirconium dioxide, a mullite, a cordierite-ized raw material, What is necessary is to be able to mention what contains the ingredient of at least 1 chosen from aluminum titanate, sialon, a kaolin, talc, an aluminum hydroxide, fused silica, and the group that consists of a quartz as a principal component, and just to choose suitably after sintering according to the engine performance called for. Moreover, it is good also as a raw material corresponding to the engine performance called for after sintering by making other ingredients, such as a crystal growth assistant and ostomy material, contain further as an additive. In addition, it cannot be overemphasized as an additive that a dispersant, a binder, etc. may be made to contain.

[0059] It is desirable to be able to mention porosity, average pore size, water absorption, or the specific heat, and to use the raw material which is different by at least one sort of these properties by this invention, for example as a property after baking of the raw material which uses a ceramic ingredient as a principal component. The range of the request in these properties is the same as that of what was shown with the honeycomb structure object of this invention, and it is desirable to prepare a raw material so that such a property may be acquired after sintering.

[0060] In addition, as a raw material of a part used as a catalyst object, adsorbent, or a filter, what uses cordierite, SiC, etc. as a principal component can be mentioned.

[0061] By the manufacture approach of this invention next, by kneading-machine style which is different in the ingredient with which the properties after baking differ, respectively, it kneads with a medium etc. and two or more plastic matters are obtained.

[0062] In this invention, although there is especially no limit about a kneading-machine style, for example, you may knead using a vacuum kneading machine, it is desirable from the point of a productivity drive to extrude with a kneading process and to perform a process continuously at a series of processes using the extruder style of the screw type mentioned later.

[0063] Moreover, what is necessary is for there to be especially no limit and just to use a desirable thing suitably in this invention, according to the raw material mentioned above about a medium.

[0064] After introducing two or more plastic matters from which the property after obtained baking differs into the location where mouthpieces differ, respectively, two or more plastic matters are extruded and fabricated by the manufacture approach of this invention next to coincidence.

[0065] The compound plastic matter which unified two or more plastic matters from which the property after baking differs as a means which extrudes and makes them coincidence after introducing two or more plastic matters from which the property after obtained baking differs into the location where mouthpieces differ, respectively can be produced, and the approach of carrying out extrusion molding of this compound plastic matter can be mentioned.

Under the present circumstances, this compound plastic matter can be obtained in the plastic matter 20 of 1 around [which consists of an ingredient of 1] the plastic matter 20 of 1 by arranging other at least one or more plastic matters 21 from which the property after baking differs, and making them into one, as shown in drawing 7. In such a compound plastic matter 22, the honeycomb structure object which joined directly the honeycomb section which consists of an ingredient of a simply different property at extruder guard of one syringe type can be acquired.

[0066] In addition, when preparing the first honeycomb section prepared in the central field mentioned above, and the second honeycomb section prepared in a periphery field in the location which makes the medial axis of a honeycomb structure object approximately concentric, the plastic matter 20 of 1 which consists of an ingredient of 1, and the plastic matter of 1 prepared in the perimeter should just form other plastic matters 21 which consist of an ingredient with which the properties after baking differ in the location used as approximately concentric.

[0067] Moreover, in order to manufacture a honeycomb structure object by extrusion molding in this invention, as for the compound plastic matter 22 mentioned above, it is desirable that the laminating of each plastic matters 20 and 21 which consist of an ingredient with which the properties after baking differ in the perpendicular direction over the direction of extrusion is carried out. Moreover, in order to raise the moldability in the case of extrusion molding, it is desirable to make small two or more plastic matters 20 from which the property after baking differs, and the gap which it is between 21, and to join it closely.

[0068] As other means which extrude and make them coincidence after introducing two or more plastic matters which consist of an ingredient of an acquired different property into the location where mouthpieces differ, respectively, two or more plastic matters from which the property after baking differs can be introduced into the location where mouthpieces differ by extruder style different, respectively, and the approach of extruding and making it into coincidence can be mentioned.

[0069] As shown in drawing 8 (a) and (b), the extruder styles 18 and 19 of two or more syringe types are specifically used as an extruder style. By supplying two or more plastic matters 20 and 21 from which the property after baking differs in the extruder style 18 of each syringe type, and 19, and carrying out by synchronizing the extrusion process in each extruder styles 18 and 19 As shown in the approach of extruding and making each plastic matters 20 and 21 coincidence or drawing 9 (a), and (b) As an extruder style, using the extruder styles 16 and 17 of two or more screw types by carrying out by synchronizing the process [medium / in each extruder styles 16 and 17 / the raw material and medium] of kneading, and the process of the extrusion of the plastic matter obtained by kneading The approach of extruding and making each plastic matters 20 and 21 coincidence can be mentioned.

[0070] The latter approach using the extruder styles 16 and 17 of a screw type is desirable at the point which can perform continuously extrusion of the plastic matter obtained by kneading with a raw material and a medium, and kneading, and can make productivity very high especially.

[0071] Moreover, as arrangement of an extruder style, as shown in drawing 10 (a) and (b), at least each part which introduces each plastic matter from which the property after baking in a mouthpiece 25 differs can respond for every [26 and] 27, and what arranged each extruder styles 16 and 17 can be mentioned, for example. But as shown in drawing 9 (a) and (b), it is also desirable to open the extruder style 17 and the specific part of a mouthpiece 25 for free passage to the extruder style 17 of at least 1, to form in it the guide section 28 which introduces a plastic matter into the specific part of a mouthpiece 25, and to arrange each extruder styles 16 and 17 in it freely according to a design etc. In addition, at extruder guard 17 which formed this guide section 28, the design of the extruder style itself can also be made very simple.

[0072] In this invention , although there be especially no limit about the configuration and structure of the mouthpiece to be use , when , prepare two or more honeycomb sections from which the cellular structures , such as a cel consistency , septum thickness , or a cross section configuration in the direction of a path of a through tube , differ for example , it be desirable to make different at least one sort of a cell block pitch , slit width , or the vertical cross section configuration over the direction of extrusion of a cell block according to the cellular structure search for .

[0073] Moreover, the thing into which the plastic matter of a substantially different property is introduced when preparing two or more honeycomb sections from which abbreviation correspondence is carried out at two or more honeycomb sections which consist of an ingredient of a different property, and the cellular structure differs and which is made different [the cellular structure] for every part is desirable.

[0074] It is more desirable that they are less than seven cels, it is desirable that the difference of the boundary like each part of the mouthpiece with which the plastic matter from which the property after baking differs is specifically

introduced, and the boundary like each part of the mouthpiece made into a different configuration and structure is less than ten cel, and it is [it is still more desirable that they are less than five cel, and] desirable that they are especially less than three cel.

[0075] By the manufacture approach of this invention, it considers as a final product by usually calcinating the Plastic solid of the acquired honeycomb structure. After baking dries a Plastic solid by microwave, hot blast, etc., calcinating is usually desirable.

[0076]

[Example] Hereafter, although an example explains this invention concretely, this invention is not limited to these examples at all. In addition, evaluation of the honeycomb structure object acquired in each example and the example of a comparison was performed by the following approaches etc.

[0077] (The evaluation approach)

1. It measured by the mercury press fit type porosimeter by the average pore size microphone ROMERI tick company.
2. It asked by count from the true specific gravity and the total pore volume of a component of a porosity honeycomb structure object. Moreover, pore volume was measured by the mercury press fit type porosimeter by the microphone ROMERI tick company.
3. Water absorption JIS R2205 It measured by the approach of a publication.

[0078] (An example and example of a comparison)

an example 1 -- the first ceramic raw material which consists of a cordierite-ized ingredient with which the properties after baking differ, respectively as a ceramic raw material first, and the second ceramic raw material were prepared, respectively.

[0079] Subsequently, with water using each ceramic raw material as a medium, it supplied to a vacuum kneading machine different, respectively, each ceramic raw material and water were kneaded and fabricated, and the plastic matter which consists of the first ceramic raw material which has the shape of a cylindrical shape with a diameter of 150mm, and the plastic matter which consists of the second ceramic raw material which has plate-like [with a width of face / of 475mm / and a thickness of 40mm] were obtained.

[0080] Subsequently, the compound plastic matter which twisted the plastic matter which consists of the second ceramic raw material which has plate-like around the perimeter of a plastic matter which consists of the first ceramic raw material which has the shape of a cylindrical shape, and was united with it was produced.

[0081] Subsequently, it supplied to the ram type extruding press machine which arranged the mouthpiece with which the cellular structures differ the compound plastic matter of the shape of an acquired cylinder in a center section with a diameter of 120mm and its periphery section, and extrusion molding was performed.

[0082] Subsequently, the through tube of the honeycomb section which consists the acquired Plastic solid of the first ceramic raw material after desiccation by hot blast and microwave After ***** (ing) alternately in respect of the both ends to penetrate and calcinating, the catalyst which uses Pt as a principal component is supported to the septum of the honeycomb section which consists of the second ceramic raw material. The with die-length [of 203mm] and a diameter of 190mm honeycomb section which is cylindrical and consists of the first ceramic raw material acquired the honeycomb structure object and the honeycomb structure object established in the cylindrical shape-like field with a diameter [of this alignment] of 120mm.

[0083] When the property of the acquired honeycomb structure object is investigated, in the honeycomb section which consists of the first ceramic raw material 0.25mm in 30 micrometers of average pore size, 91% of water absorption, 70% of porosity, septum thickness In the honeycomb section which the cross-section configuration of cel consistency 0.465 cel / mm² (300 cel / square inch), and the direction of a path of a through tube is a square, and becomes from the second ceramic raw material It was the cross-section configuration square of 0.1mm [in 5 micrometers of average pore size, 17% of water absorption, 30% of porosity, and septum thickness], and cel consistency 0.930 cel / mm² (600 cel / square inch), and the direction of a path of a through tube.

[0084] Moreover, as shown in drawing 11, this honeycomb structure object 1 was grasped in the metal case 40, and the exhaust pipe 41 of a 2400 cc diesel power plant was made to correspond to the first honeycomb section 11 which consists of the first ceramic raw material, it arranged, and the exhaust gas purge was produced.

[0085] Exhaust gas is introduced from the exhaust gas installation way 39 formed with the outer wall of an exhaust pipe 41, and the wall of a metal case. The second honeycomb section 10 which functions as a catalyst object which consists of the second ceramic raw material and changes NO into NO₂, When it was made to go via the first

honeycomb section 11 which consists of the first ceramic raw material and functions considering particulate matter as uptake and a filter to remove in order and exhaust gas was purified, the outstanding emission-gas-purification engine performance was accepted. Moreover, about the honeycomb structure object after a trial, when damage, deformation, etc. were checked, the damage on exfoliation, a crack, etc., the deformation of a through tube including the joint of both the honeycomb section, etc. were not accepted at all. In addition, the arrow head in drawing 11 shows the travelling direction of exhaust gas.

[0086] an example 2 -- the first ceramic raw material and the second ceramic raw material which consist of a silicon carbide ingredient with which the properties after baking differ, respectively as ceramic raw materials first were prepared, respectively.

[0087] Subsequently, the screw-type extruder style of 1 which extrudes and carries out the first ceramic raw material It is prepared corresponding to a center section with a central point [of the inlet-port end face of a mouthpiece], and a diameter [of this alignment] of 90mm. The extrusion-molding equipment which has the guide section which other screw-type extruder styles which extrude and carry out the second ceramic raw material open for free passage in a center section and the periphery section of this alignment of the mouthpiece mentioned above is used. Each ceramic raw material with a medium It supplied to a screw-type extruder style different, respectively, and kneading and extrusion molding of each plastic matter obtained were synchronized at each extruder guard, and was performed, and the Plastic solid of honeycomb structure was produced. Under the present circumstances, as a mouthpiece, that from which the cellular structure differs in a center section and the periphery section was used.

[0088] Subsequently, it calcinated, after ******(ing) alternately the through tube of the honeycomb section which consists the acquired Plastic solid of the first ceramic raw material after desiccation by microwave in respect of the both ends to penetrate. Then, the catalyst which uses Pt as a principal component was supported to the septum of the honeycomb section which consists of the second ceramic raw material, and the honeycomb section which consists of the first ceramic raw material acquired the honeycomb structure object and the honeycomb structure object of the shape of a cylinder with a die length [of 152mm], and a diameter of 144mm established in the cylindrical shape-like field with a diameter [of this alignment] of 90mm.

[0089] When the property of the acquired honeycomb structure object is investigated, in the honeycomb section which consists of the first ceramic raw material 0.3mm in 10 micrometers of average pore size, 45% of porosity, 27% of water absorption, septum thickness In the honeycomb section which is the cross-section configuration square of cel consistency 0.310 cel / mm² (200 cel / square inch), and the direction of a path of a through tube, and consists of the second ceramic raw material The cross-section configuration of 0.15mm [in 4 micrometers of average pore size, 20% of porosity, 9% of water absorption, and septum thickness] and cel consistency 0.620 cel / mm² (400 cel / square inch), and the direction of a path of a through tube was a hexagon.

[0090] Moreover, as shown in drawing 11 , this honeycomb structure object 1 was grasped in the metal case 40, and the exhaust pipe 41 of a 2400 cc diesel power plant was made to correspond to the first honeycomb section 11 which consists of the first ceramic raw material, it arranged, and the exhaust gas purge was produced.

[0091] Exhaust gas is introduced from the exhaust gas installation way 39 formed with the outer wall of an exhaust pipe 41, and the wall of a metal case. The second honeycomb section 10 which functions as a catalyst object which consists of the second ceramic raw material and changes NO into NO₂, When it was made to go via the first honeycomb section 11 which consists of the first ceramic raw material and functions considering particulate matter as uptake and a filter to remove in order and exhaust gas was purified, the outstanding emission-gas-purification engine performance was accepted. Moreover, about the honeycomb structure object after a trial, when damage, deformation, etc. were checked, the damage on exfoliation, a crack, etc., the deformation of a through tube including the joint of both the honeycomb section, etc. were not accepted at all. In addition, the arrow head in drawing 11 shows the travelling direction of exhaust gas.

[0092] an example 3 -- the first ceramic raw material which consists of a cordierite-ized ingredient with which the properties after baking differ, respectively as a ceramic raw material first, and the second ceramic raw material were prepared, respectively.

[0093] Subsequently, the extruder style of the screw type of 1 which extrudes and carries out the first ceramic raw material is arranged corresponding to the center section of a mouthpiece. Other screw-type extruder styles which have two or more screws which extrude and carry out the second ceramic raw material Each ceramic raw material is thrown into a screw-type extruder style different, respectively using the extrusion-molding equipment arranged in the periphery

section of the screw-type extruder style of 1. Kneading of each ceramic raw material and the extrusion of each plastic matter obtained were synchronized at each extruder guard, and was performed, and the Plastic solid of honeycomb structure was produced. Under the present circumstances, as a mouthpiece, that from which the cellular structure differs in a center section and the periphery section was used.

[0094] subsequently, after drying and calcinating the acquired Plastic solid, to the septum of the honeycomb section which consists of the second ceramic raw material To the septum of the honeycomb section which supports the catalyst which uses Pt and Pd as a principal component, and consists of the first ceramic raw material Zeolite The adsorption layer which uses ZSM-5 (product made from The PQ) as a principal component is prepared. The honeycomb section which consists of the first ceramic raw material acquired the honeycomb structure object and the honeycomb structure object of the shape of a cylinder with a die length [of 152mm], and a diameter of 144mm established in the cylindrical shape-like field with a diameter [of this alignment] of 45mm.

[0095] When the property of the acquired honeycomb structure object is investigated, in the honeycomb section which consists of the first ceramic raw material 150 micrometers in 3 micrometers of average pore size, 10% of water absorption, 20% of porosity, septum thickness In the honeycomb section which is the cross-section configuration triangle of 0.620 cels / mm² (cel consistency 400 cel / square inch), and the direction of a path of a through tube, and consists of the second ceramic raw material The cross-section configuration of 100-micrometer [in 7 micrometers of average pore size, 22% of water absorption, 35% of porosity, and septum thickness] and cel consistency 0.465 cel / mm² (300 cel / square inch), and the direction of a path of a through tube was a hexagon.

[0096] Moreover, this honeycomb structure object was grasped in the metal case, the exhaust pipe of a 3000 cc gasoline engine was arranged corresponding to the end face of 1 of a honeycomb structure object, and the exhaust gas purge was produced.

[0097] When it introduced into the second honeycomb section which functions as a three way component catalyst object which consists exhaust gas of the second ceramic raw material, and carries out oxidation reduction of HC, CO, and NO_x, and the first honeycomb section which functions as adsorbent which consists of the first ceramic raw material and adsorbs a hydrocarbon component and exhaust gas was purified, the outstanding emission-gas-purification engine performance was accepted. Moreover, about the honeycomb structure object after a trial, when damage, deformation, etc. were checked, the damage on exfoliation, a crack, etc., the deformation of a through tube including the joint of both the honeycomb section, etc. were not accepted at all.

[0098] The honeycomb structure object of the shape of a cylinder with a die length [of 203mm] and a diameter of 190mm was acquired like the example 1 to the whole except having used what has the same cellular structure as having used the raw material with which the property after baking consists of the same cordierite-ized ingredient whose number is one as an example of comparison 1 ceramic raw material, and a mouthpiece.

[0099] When the property of the acquired honeycomb structure object was investigated, the cross-section configuration of 0.25mm [in 7 micrometers of average pore size, 22% of water absorption 35% of porosity, and septum thickness] and cel consistency 0.465 cel / mm² (300 cel / square inch), and the direction of a path of a through tube was a square with the whole honeycomb structure object.

[0100] Moreover, as shown in drawing 11 , this honeycomb structure object 1 was grasped in the metal case 40, and the exhaust pipe 41 of a 2400 cc diesel power plant was made to correspond to the first honeycomb section 11 which consists of the first ceramic raw material, it equipped, and the exhaust gas purge was produced.

[0101] Exhaust gas is introduced from the exhaust gas installation way 39 formed with the outer wall of an exhaust pipe 41, and the wall of a metal case. The second honeycomb section 10 operated as a catalyst object which changes NO into NO₂, The place which was made to go via the first honeycomb section 11 as which particulate matter was operated as uptake and a filter to remove in order, and purified exhaust gas, The pressure loss of the first honeycomb section 11 operated as a filter became large 3 or more times compared with the honeycomb structure object of an example 1, and did not function enough as an exhaust gas purge. In addition, the arrow head in drawing 11 shows the travelling direction of exhaust gas.

[0102]

[Effect of the Invention] According to this invention, as explained above, different high engine performance according to a demand can be demonstrated for every honeycomb section, moreover, there is no local stress concentration by existence of the configuration mismatching of each honeycomb section and a jointing material for corrugated fibreboard, and the especially suitable honeycomb structure object for heat sound engines, such as an emission-gas-

purification system, a heat exchanger, a solid electrolyte cell, and a sound wave-motion cooling system, etc. with the high dependability at the time of use etc. can be offered. Moreover, this invention can offer the manufacture approach that the honeycomb structure object which has such an outstanding property can be manufactured by low cost according to a simple and positive stroke.

[Translation done.]

* NOTICES *

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damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.

2. **** shows the word which can not be translated.

3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] The honeycomb structure object which is a honeycomb structure object by which two or more through tubes are formed in shaft orientations by two or more septa, and is characterized by being constituted by two or more honeycomb sections which consist of an ingredient of the property that these honeycomb structure objects differ, and for these two or more honeycomb sections joining directly, and unifying them, respectively.

[Claim 2] this -- ** -- a property -- an ingredient -- from -- becoming -- plurality -- a honeycomb -- the section -- honeycomb structure -- the body -- a medial axis -- containing -- a center -- a field -- preparing -- having -- differing -- a property -- one -- an ingredient -- from -- becoming -- the -- one -- a honeycomb -- the section -- a center -- a field -- surrounding -- adjoining -- a periphery -- a field -- preparing -- having -- differing -- a property -- others -- an ingredient -- from -- becoming -- the -- two -- a honeycomb -- the section -- constituting -- having -- *** -- being according to claim 1 -- honeycomb structure -- the body .

[Claim 3] The honeycomb structure object according to claim 1 or 2 from which the ingredient which constitutes these two or more honeycomb sections is different in porosity, average pore size, or at least one sort of properties of water absorption.

[Claim 4] A honeycomb structure object given in any 1 term of claims 1-3 whose ingredients which constitute these two or more honeycomb sections are 5 - 80% of porosity.

[Claim 5] A honeycomb structure object given in any 1 term of claims 1-4 whose ingredients which constitute these two or more honeycomb sections are 0.5-100 micrometers of average pore size.

[Claim 6] A honeycomb structure object given in any 1 term of claims 1-5 whose ingredients which constitute these two or more honeycomb sections are 1 - 95% of water absorption.

[Claim 7] A honeycomb structure object given in any 1 term of claims 1-6 constituted by two or more honeycomb sections from which this honeycomb structure object differs by at least one sort of a cel consistency, septum thickness, or the cross-section configuration of the direction of a path in this through tube in the cellular structure.

[Claim 8] this -- ** -- two or more honeycomb sections of the cellular structure -- this -- ** -- a honeycomb structure object given in any 1 term of claims 1-7 established substantially corresponding to two or more honeycomb sections which consist of an ingredient of a property.

[Claim 9] The honeycomb structure object according to claim 7 or 8 with which these two or more honeycomb sections have 0.155 to 3.101 cel / cel consistency of mm² (100-2000 cel / square inch).

[Claim 10] A honeycomb structure object given in any 1 term of claims 7-9 in which the septum of two or more of these honeycomb sections has the thickness of 25-500 micrometers.

[Claim 11] A honeycomb structure object given in any 1 term of claims 1-10 which are at least one sort chosen from the group which the ingredient which constitutes these two or more honeycomb sections becomes from cordierite, silicon carbide, silicon nitride, an alumina, a mullite, lithium aluminium silicate, aluminum titanate, and a zirconia.

[Claim 12] A honeycomb structure object given in any 1 term of claims 1-11 by which these a part of two or more honeycomb sections come to support the metal which has catalyst ability to this septum.

[Claim 13] A honeycomb structure object given in any 1 term of claims 1-12 to which these a part of two or more honeycomb sections have the adsorption layer which adsorbs a hydrocarbon to this septum.

[Claim 14] It is a honeycomb structure object given in any 1 term of claims 1-13 which these a part of two or more honeycomb sections are constituted by the septum which has filtration ability, stop one edge about a predetermined

through tube in respect of the both ends where this through tube penetrates the through tube formed by the septum which has this filtration ability, stop the other-end section about a residual through tube, and come to *****.

[Claim 15] The honeycomb structure object according to claim 14 used considering the particulate matter contained in dust-containing fluid as uptake and a filter to remove.

[Claim 16] As a raw material which is the manufacture approach of the honeycomb structure object which kneads the raw material and medium which use a ceramic ingredient as a principal component, obtains a plastic matter, and carries out extrusion molding of this plastic matter, and uses this ceramic ingredient as a principal component These two or more raw materials are kneaded with this medium at kneading-machine guard different, respectively using two or more raw materials with which the properties after baking differ. The manufacture approach of the honeycomb structure object characterized by extruding and making these two or more plastic matters into coincidence after obtaining two or more plastic matters from which the property after baking differs and introducing these two or more plastic matters into the location where mouthpieces differ, respectively.

[Claim 17] The manufacture approach of the honeycomb structure object according to claim 16 which introduces into the mouth piece the compound plastic matter which unified these two or more plastic matters, and extrudes and makes coincidence these two or more plastic matters.

[Claim 18] the perimeter of the plastic matter of 1 to which this compound plastic matter consists of an ingredient of 1 - - this -- the manufacture approach of a honeycomb structure object according to claim 17 that the plastic matter of 1 is a thing which comes to arrange other at least one or more plastic matters from which the property after baking differs.

[Claim 19] The manufacture approach of the honeycomb structure object according to claim 18 which introduces these two or more plastic matters into the location where mouthpieces differ, and extrudes and makes them coincidence by extruder style different, respectively.

[Claim 20] The manufacture approach of the honeycomb structure object according to claim 19 which is the extruder style of the screw type to which this extruder style performs continuously extrusion of the plastic matter obtained by kneading with the raw material and this medium which use this ceramic ingredient as a principal component, and this kneading according to a series of processes.

[Claim 21] The manufacture approach of a honeycomb structure object given in any 1 term of claims 16-20 from which these two or more raw materials differ by at least one sort of porosity, average pore size, or water absorption in the property after the baking.

[Claim 22] The manufacture approach of a honeycomb structure object given in any 1 term of claims 16-21 from which at least one sort of the cell block pitch of the mouth piece, slit width, or the vertical cross-section configuration over the direction of extrusion of a cell block is substantially different for every part where each plastic matter from which the property after this baking differs is introduced.

[Translation done.]